

Sub 3  
1. A network for forwarding packets from a source device to a destination device, said network including a plurality of network elements including nodes and connecting links, a master server for monitoring the network and establishing an initial route between the source device and the destination device, wherein at least one node comprises:

5 a processor to compute an alternative route for the initial route;  
a storage space to store the initial route and the alternative route;  
a mechanism to detect failure in a downstream network element in the initial route;

and

a forwarder to automatically forward a packet to the next node.

10 2. The node in claim 1, wherein the network is a connection-oriented network with a plurality of established initial routes.

15 3. The node in claim 2, wherein the node is a label-switched router.

Sub 4  
20 4. The node in claim 1, wherein the processor computes an alternative route not including the downstream node and link on the initial route.

5. The node in claim 4, wherein the processor computes an alternative route not including a plurality of nodes associated with the downstream node and link as likely to fail according to network configuration data.

25 6. The node in claim 1, wherein the mechanism to detect failure sends communication packets to downstream nodes at regular intervals.

7. The node in claim 3, wherein the forwarder swaps a label on a packet with another value and forwards the packet to the next node.

30 Sub 5  
A method for forwarding packets from a source device to a destination device in a

BA Cont  
network of interconnected elements including nodes and links, comprising:

determining an initial route;

determining an alternative route;

forwarding packets on the initial route;

5 detecting a failed element; and

automatically forwarding packets on the alternative route without communicating with either the source or the destination;

9. The method of claim 8, wherein determining the initial route further comprises:

10 determining a shortest path from the destination device to the source device within the network;

refining the path according to administrative constraints; and

establishing the path as the initial route.

15 10. The method of claim 9, wherein refining the path comprises rejecting the path exceeding bandwidth allocation and hop limit.

11. The method of claim 8, wherein determining the alternative route further comprises:

20 determining a shortest route from a node preceding the failed element to the destination device within the network;

refining the route to exclude the failed element on the initial route; and

establishing the alternative route for forwarding packets.

25 12. The method of claim 8, wherein detecting a failure is conducted locally by a node preceding the failed element without requiring notification of a master server or an ingress node.

13. The method of claim 8, wherein determining the alternative route comprises:

reserving bandwidth available on the initial route;

30 generating the alternative route by invoking a routing protocol;

refining the alternative route by excluding the failed element; and  
establishing the alternative route.

Sub 37  
14. The method of claim 9, wherein the initial route is prioritized to establish a hierarchy  
5 for preemption in routing network traffic.

15. The method of claim 8, wherein the determining the alternative route comprises  
checking bandwidth allocation.

10 16. The method of claim 15, wherein checking bandwidth allocation comprises  
dynamically balancing capacity of nodes and links.

15 17. The method of claim 8, wherein determining the alternative route comprises:  
reserving bandwidth available on the initial route;  
identifying a plurality of nodes associated with the failed node according to network  
configuration information;  
generating the alternative route excluding the failed node and the plurality of nodes;  
establishing the alternative route.

Sub 38  
20 18. A method for locally rerouting packets traveling on an established route when a node  
in a network of interconnected nodes fails, the method comprising:  
computing, at a plurality of intermediary nodes along the initial route, an alternative  
route leading from the computing node to the destination device of the established route;  
determining locally that the established route has failed; and  
25 automatically forwarding packets according on the alternative route.

19. The method of claim 18, wherein computing the alternative route comprises:  
reserving bandwidth available on the initial route;  
identifying a plurality of nodes associated with the failed node according to network  
30 configuration information;

generating the alternative route excluding the failed node and the plurality of nodes;  
and  
establishing the alternative route.

5 20. The method of claim 19, wherein computing the alternative route further comprises:  
locating a set of established routes with a same destination device and same  
administrative constraints as the initial route;

finding a common node, downstream from the failed node, after which the set of  
established routes and the initial route utilize the same network elements;

10 establishing a new route from the common node to the destination device; and  
incorporating the new route into the alternative route.

15 21. The method of claim 18, wherein determining locally that the established route has  
failed is conducted by a signaling protocol.

22. An apparatus for rapidly resuming, at times of failures, network traffic in a  
connection-oriented network by using an alternative route pre-computed and stored locally in  
nodes along an initial route without requiring signaling of upstream nodes or a master server.

20 23. A method for rapidly resuming, at times of failures, network traffic in a connection-  
oriented network by using an alternative route pre-computed and stored locally in nodes along  
an initial route without requiring signaling of upstream nodes or a master server.

Add B5